

## **ECHO: MACHINE FEASIBILITY PROGRAM**

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### **INTRODUCTION**

Reductions in saw kerf (the term saw kerf refers to both the sawtooth width as well as the actual sawline made in sawing) on headrigs and resaws can dramatically increase lumber recovery. Research has also shown that lumber target size reductions are even more important than kerf reductions in providing increased lumber recovery. Decreases in either kerf or lumber size, however, always come at some expense in both capital and variable costs. Determining whether the financial benefits from increased lumber yield outweigh the incurred costs can be a difficult task. The Economic Choice for Hardwood Sawmill Operations (**ECHO**) is a software package developed to help analyze the economic benefit of installing thinner-kerf and higher-accuracy sawing machines. Replacement of headrigs and resaws with reduced kerfs and increased sawing accuracy can be tested.

ECHO will assist in the estimation of the increased lumber recovery and the resultant increased revenue from reducing kerf or lumber sizes on headrigs and resaws. As an alternative, users may make their own increased revenue estimate. Users must also determine the estimated increased costs expected from equipment changes. Based on the estimated increased revenues and costs, a discounted cash flow analysis is performed by ECHO. The investment feasibility measures of present net value, rate of return, and payback period are provided. Federal tax implications are addressed by the software.

Circular headrigs can consume 0.131 inch more wood fiber in kerf and sawing variation per sawline than band headrigs. This increased loss of wood fiber by circular headrigs translates into a 10 to 12 percent loss in lumber yield for the volume of lumber sawn by the circular headrig. This magnitude of loss indicates that sawmillers with circular saws should consider installing a band headrig.

Circular headrigs reduce overhead costs for hardwood sawmills. Circular headrigs with inserted teeth can be maintained by the sawyer or other sawmill personnel with a few minutes of maintenance each day. Insertion of teeth and sharpening can be performed while the saw remains on the arbor. Band headrigs require more capital on installation and require more maintenance and saw filing. Maintenance of bandsaw blades requires that they be removed from the saw for sharpening. A full-time filer and capital investment in a filing room and specialized filing equipment are usually required.

Some hardwood sawmills will benefit financially from circular headrigs. Operations that saw a high percentage of cants or ties may lose only a small amount of wood fiber from a circular saw compared to a thinner-kerf bandsaw. Also, sawmills may be too small to support the increased per-unit costs required for a band headrig.

Modern resaws are able to saw with substantially thinner kerfs and lower sawing variation than those available even a decade ago. However, a significant capital outlay for this new technology and increased maintenance costs should be expected.

ECHO is computer software that incorporates the skills of a trained investment analyst to assist sawmill managers in developing a detailed analysis of the investment results from expenditures for thin-kerf sawing equipment and services. Although the ECHO software is detailed and accurate, it is not intended to be the final estimate of financial feasibility. Obtaining professional investment advice is necessary to prevent errors of judgement in performing the analysis.

This paper describes how to perform an analysis of an investment in thin-kerf sawing by describing the steps performed by ECHO to determine payback period, rate of return, and present net worth. The logic behind the ECHO steps to perform the analysis is explained with information for an example sawmill investment. The explanation of this logic should assist those who desire to perform such an analysis to do so even without the ECHO software.

## ESTIMATING INVESTMENT COSTS

Investment analysis reduces risk by accurately estimating the costs and benefits that will result from a proposed investment. Investment costs can be determined by contacting vendors of the equipment and services required. While software is of no assistance in developing accurate cost estimates, the ECHO software does prompt the user for most cost items that may be incurred when investing in thin-kerf sawing. This may help to reduce the risk of overlooking costs involved in the investment.

The following hypothetical situation supposes that the management of a sawmill desires to replace its circular headrig with a new band headrig. Note that ECHO is also able to analyze installation of a thin-kerf resaw in addition to, or instead of, analyzing investments in a band headrig.

The costs and benefits assumed in the following analysis are hypothetical and are intended to be illustrative only.

### INVESTMENT COSTS

Band headrig (6')	\$120,000
Filing room equipment	25,000
Filing room	40,000
Installation costs	15,000
Sawblades, initial cost	5,000
Sawbrake	5,000
<u>Debarker</u>	<u>35,000</u>
Total	\$245,000

The ECHO software prompts users for investment costs in the above categories and some additional categories. Other investments, however, may be required for which ECHO does not explicitly prompt. For example, a sawpit is frequently required when a band headrig is installed in the location formerly occupied by a circular headrig in a sawmill that does not have equipment installed on a raised foundation. The expense for this sawpit must be included as an investment expense in the analysis. For this purpose, the software asks the user for any general investment costs that may be incurred in addition to those specifically prompted. Any investment expenses for which there is no prompt must be entered in the category of additional investment expenses.

For this example annual costs are estimated to increase as a result of the band headrig installation as follows:

#### ESTIMATED ANNUAL COSTS

Headrig maintenance	\$ 1,150
Saw blade replacement	2,300
Grinding wheels and guides	1,150
Annual wheel resurfacing	575
<u>Filer salary &amp; Benefits</u>	<u>43,700</u>
Total	\$48,875

ECHO prompts the user to enter values for each of these variable costs. However, as with investment costs, variable costs may be incurred for which there is no specific prompt. For these costs, the user is prompted by ECHO to enter the total value of all additional variable costs for which there was no prompt. For this example, it is assumed that all costs were accounted for by the specific prompts provided by ECHO and a zero is entered at the additional variable cost prompt.

The increased conversion efficiency that will result from the reduction in kerf from the current investment is estimated by ECHO based on the difference in the current and new kerf. The kerf width for this example's circular headrig is currently 0.280 inch. Some hardwood sawmills are currently able to saw with 0.140-inch band headrig kerfs. However, our sawmill management wishes to be conservative and chooses to begin sawing on the band headrig with a kerf width of 0.165 inch. Therefore, the sawmill will realize a wood fiber saving due to kerf reduction of 0.115 inch for each sawline made by the headrig. It is also assumed that the new saw will have increased accuracy and that reduced sawing variation will result in a target size reduction of 0.010 inch. Therefore, the target size will be reduced for 4/4 lumber from 1.125 inches to 1.115 inches and for 5/4 lumber from 1.375 inches to 1.365 inches.

The ECHO software also requires information on each sawmill's current average log diameter and length because potential conversion efficiency improvement percentages are related to the average log size processed. For this sawmill, the average log diameter is estimated to be 16 inches and average log length is estimated to be 12 feet.

An additional piece of information required by ECHO is the percentage of total production accounted for by each lumber thickness. Changes in rough green size influence lumber yield differently depending on the actual thickness of each lumber size produced. The same value reduction in rough green size will increase yield more for 4/4 lumber than for 5/4 lumber, for example. For this reason, ECHO prompts the user for the proportion of each thickness as a percentage of total volume production that is produced by the sawmill. For this example sawmill, the production of 4/4 and 5/4 lumber are assumed to be equivalent volumes with 50 percent of each produced.

Next, the user must realize that installation of a new band headrig will not obtain increased conversion efficiency for that percentage of lumber production processed at a resaw. The ECHO software handles this situation by prompting for the percentages of lumber of each size processed at the headrig versus the resaw. For this example, it is assumed that 70 percent of lumber production is at the headrig and 30 percent is at the resaw for both 4/4 and 5/4 lumber thicknesses.

Cants that are not cut into dimension lumber will also not result in conversion efficiency improvement because the improved sawing variation is not a significant consideration in cant sizing. For this reason, the average

percentage of log volume processed in cants must also be estimated by the user to allow ECHO to account for this factor. For our example, we will assume that 30 percent of the sawmill production is produced as cants in the form of railroad ties.

Based on the information we've provided, the ECHO program can now compute the estimated percentage improvement in lumber production. For our example, the estimated yield increase is 4.39 percent.

Summarizing the analysis to this point, with the installation of a new band headrig sawmill, management can reduce wood fiber per sawline by a total of 0.115 inch. The total investment cost is \$245,000, with recurring annual costs of \$48,875. The increased potential conversion efficiency of 4.39 percent is allocated 100 percent to increased lumber production. Total increased revenue from these changes is estimated by ECHO to be \$243,644 per year.

ECHO now has nearly all of the information required to perform a 10-year discounted cash flow analysis to provide the investment feasibility measures of payback period, after-tax rate-of-return, and present net worth. Additional information required to compute these measures of investment feasibility are the discount rate, income tax rate, and insurance and property tax rates. The discount rate is usually considered to be that rate of return that the sawmill could obtain from placing capital in the best available alternative investment. The discount rate can also be understood to be that rate of return that the sawmill requires in order to make the investment. The discount rate for the after-tax analysis performed by ECHO should account for inflation. For this example, sawmill management determines that 12.5 percent is the best alternative investment available for its funds and chooses this as the discount rate. The tax rate for the sawmill is 28 percent, and the insurance and property tax rates are 1 and 3 percent, of assets, respectively.

ECHO performs a discounted cash flow analysis with the described inputs. All measures of feasibility are after-tax values, with depreciation considered by the straight-line method. The payback period from the investment in the band headrig is estimated to be 1.71 years. The after-tax rate of return is 58.02 percent. Present net worth is \$550,213.

The measure-of-feasibility values resulting from this analysis indicate that the proposed investment is very attractive. However, sawmill management should not initiate consideration of such an investment based on a single ECHO analysis. A sensitivity analysis should be performed to determine those cost and benefit values that may have a large impact on the outcome of the investment. For example, sawmill managers that have experienced many market downturns and lower lumber sales prices will want to perform a worst-case analysis of such a situation. When lumber markets are poor, both log costs and lumber prices decrease, but their relationship to one another may change such that the investment outcome will differ. The results of these changed relationships can be explored by making additional ECHO runs based on historical log and lumber costs in down markets. It is also a mistake to base the investment feasibility only on log and lumber prices experienced during poor market conditions, as these prices will rarely last for the length of time the investment is being paid off. Additional analyses with average prices expected over the term of the investment should be performed.

Other cost and benefit values that are subject to change during the investment period should also be tested to determine their potential influence on the investment outcome should such change actually occur.

ECHO is a tool designed to perform a preliminary analysis to estimate the potential of an investment in thin-kerf sawing. However, the opinion of an experienced investment analyst should be obtained prior to undertaking an actual investment.

The ECHO software and a user's manual are available at no cost. Information on ordering ECHO is available from the senior author:

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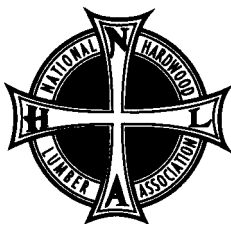
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*PROCEEDINGS OF THE TWENTY-EIGHTH  
ANNUAL HARDWOOD SYMPOSIUM*

*West Virginia Now—The Future  
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**Canaan Valley Resort & Conf. Center  
Davis, West Virginia  
May 11-13, 2000**



# **ACKNOWLEDGEMENT**

Assistance in producing the Proceedings of the Twenty-Eighth  
Annual Hardwood Symposium was provided by the

**USDA Forest Service  
Southern Research Station  
Asheville, NC**

These proceedings contain papers presented at the Twenty-Eighth Annual Hardwood Symposium. The results reported and the opinions expressed are those of the authors. NHLA assumes no responsibility for the content of these proceedings beyond reasonable acceptance for conformity to style.

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